

IDENTIFYING DATA				
Laser Technology Applied to Industrial Production				
Subject	Laser Technology Applied to Industrial Production			
Code	V04M141V01339			
Study programme	(*)Máster Universitario en Enxeñaría Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	2nd	1st
Teaching language				
Department				
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Lecturers	Pou Saracho, Juan María Quintero Martínez, Félix Trillo Yáñez, María Cristina			
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General description	This course provides the future industrial engineer a vision of the role of laser technology in industrial production , so as to acquire basic knowledge about laser -assisted processes used in the industry. It also seeks the student to identify knows the different applications of industrial interest in the laser plays a major role and those in which the laser has a promising future in the coming years.			

Competencies	
Code	
A1	CB6. Knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context.
A3	CB8. That students are able to integrate knowledge and handle complexity and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.
A5	CB10. Students must possess the learning skills that enable them to continue studying in a way that will be largely self-directed or autonomous.
C3	CET3. Conduct research, development and innovation in products, processes and methods.
C13	CTI2. Knowledge and ability to design, calculate and design integrated manufacturing systems.

Learning outcomes	
Expected results from this subject	Training and Learning Results
Distinguish the different types of industrial laser systems.	A1 A3 C13
Knowledge about the main industrial laser applications and to apply this knowledge to particular industrial processes	A1 A3 A5 C3 C13

Contents
Topic

SUBJECT 1.- LASER CUTTING	1.1.- Introduction. 1.2.- Characteristics of laser cutting. 1.3.- Types of laser cutting. 1.4.- Mechanisms of laser cutting. 1.5.- Parameters of the process. 1.6.- Influence of different variables in the laser cutting quality. 1.7.- Examples and applications.
SUBJECT 2.- LASER DRILLING	2.1.- Introduction. 2.2.- Characteristics of laser drilling. 2.4.- Mechanisms of laser drilling. 2.5.- Parameters of the process. 2.6.- Influence of different variables in the process. 2.7.- Examples and applications.
SUBJECT 3.- LASER MARKING	3.1.- Introduction. 3.2.- CharacteristicS of laser marking. 3.4.- Mechanisms of laser marking. 3.5.- Parameters of the process. 3.6.- Influence of different variables in the process. 3.7.- Examples and applications.
SUBJECT 4.- LASER WELDING	4.1.- Basic principles. 4.2.- Parameters of processing. 4.3.- Types of laser welding. 4.4.- Conduction welding. 4.5.- Penetration welding. 4.6.- Welding of dissimilar materials. 4.7.- Hybrid welding. 4.8.- Examples and applications.
SUBJECT 5.- LASER SURFACE TREATMENTS	5.1.- Introduction. 5.2.- Laser surface hardening. 5.3.- Laser assisted surface coating. 5.4.- LCVD. 5.5.- PLD. 5.6.- Laser cladding. 5.7.- Laser surface alloying. 5.8.- Other laser assisted surface treatments.
SUBJECT 6.- LASER ASSISTED RAPID PROTOTYPING.	6.1.- Introduction and glossary. 6.2.- Fundamentals of laser assisted prototyping. 6.3.- Rapid prototyping techniques. 6.4.- Selective laser sintering. 6.4.1.- Experimental system. 6.4.2.- Materials. 6.4.3.- Applications. 6.5.- Laminated object manufacturing. 6.6.- Direct light Fabrication-Laser engineered net shaping process- laser consolidation 6.7.- Comparison of laser assisted rapid prototyping systems
SUBJECT 7.- INDUSTRIAL LASER SYSTEMS	7.1.- High power lasers. 7.2.- Industrial laser sources. 7.3.- Laser assisted processing systems. 7.4.- Industrial components for laser guiding. 7.5.- Laser working heads. 7.6.- Process sensors. 7.7.- Working stations.
SUBJECT 8.- SAFETY IN INDUSTRIAL LASER SYSTEMS	8.1.- Hazards derived from the utilisation of lasers. 8.2.- Biological effects. 8.2.1.- Ocular damages. 8.2.2.- Damages to the skin. 8.3.- Hazards associated to laser system. 8.4.- Hazards associated to laser process. 8.5.- Classification of systems laser according to safety criteria. 8.6.- Hazard prevention.

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practises	20	40	60
Master Session	16	32	48
Long answer tests and development	1.7	0	1.7

Reports / memories of practice	2	0	2
Short answer tests	0.8	0	0.8

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Laboratory practises	Activities of application of the knowledge to specific situations and of acquisition of basic and practical skills related to the matter object of study. They will be developped in the laboratories of industrial applications of the lasers of the EEI.
Master Session	Exhibition on the part of the teacher of the contents on the matter object of study. Exhibition of real cases of application of the laser technology in the industry.

Personalized attention

Methodologies	Description
Laboratory practises	

Assessment

	Description	Qualification	Training and Learning Results	
Long answer tests and development	The examination will consist of five questions of equal value. Four of them will correspond to the contents of theory and the fifth one to the contents seen in the laboratory practices.	70	A1 A3	C13
Reports / memories of practice	The evaluation of the laboratory practices will be carried out by means of the qualification of the corresponding practice reports.	20	A1 A3 A5	C3 C13
Short answer tests	During the course there will be carried out a test of follow-up of the subject that will consist of two questions of equal value.	10	A1 A3	C13

Other comments on the Evaluation

If some student was resigning officially the continuous assessment that is carried out by means of the test of follow-up of the subject, the final note would be calculated by the following formula:
(0.8 x Exam qualification) + (0.2 x Practices qualification).

It is mandatory to carry out the laboratory parctices in order to pass the subject.

It is mandatory to attend the 75% of the theory lessons.

Ethical commitment: it is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

The use of any electronic device for the assessment tests is not allowed unless explicitly authorized. The fact of introducing unauthorized electronic device in the examination room will be considered reason for not passing the subject in the current academic year and will hold overall rating (0.0).

Sources of information

Jeff Hecht, **UNDERSTANDING LASERS: AN ENTRY-LEVEL GUIDE**, IEEE, New York, EE.UU.,

William M. Steen, **LASER MATERIALS PROCESSING**, Springer, Londres, Reino Unido,,

M. Dorronsoro, **LA TECNOLOGÍA LÁSER: FUNDAMENTOS APLICACIONES Y TENDENCIAS**, Ed. McGraw Hill,

John C. Ion., **LASER PROCESSING OF ENGINEERING MATERIALS: PRINCIPLES, PROCEDURE AND INDUSTRIAL APPLICATIONS**, Elsevier-Butterworth-Heinemann, Oxford, Reino Unido,

Charles L. Caristan, **LASER CUTTING GUIDE FOR MANUFACTURING**, Society of Manufacturing Engineers, Dearborn, EE.UU.,

Recommendations

Other comments

Requirements: To register for this module the student must have passed or be registered for all the modules of the previous

year.